

DUNN & SMITH ASSOCIATES
Mineral Development and Property Management
Consulting Engineers and Geologists

FILE DOE/045/028

RECEIVED

NOV 04 1985

DIVISION OF OIL
GAS & MINING

AZEREDO MINERALS, INCORPORATED
OPHER HEAP LEACH PROJECT

Barnes-Phariss Associates
Mineral Development and Property Management
Consulting Engineers and Geologists

Azeredo Minerals, Incorporated
7750 North Cedar Way, Box #1
Park City, Utah 84060

Gentlemen:

Submitted herewith is our Permitting and Licensing Report for your proposed start-up heap leach operation near Opher, Utah.

The information presented is structured to satisfy your needs with respect to a Tooele County Conditional Use Permit, presentations to the various divisions of the Utah Department of Health and the Bureau of Land Management, and an exemption application to the Utah Division of Oil, Gas and Mining.

The suitability of this report for the foregoing purposes assumes that no more than two acres of surface area will be disturbed by the proposed operation, that no mining will be conducted (existing mine dumps are to be processed), and that only 10,000 - 20,000 tons of material will be processed at the site described before full permitting is sought.

Sincerely yours,

BARNES-PHARISS ASSOCIATES

E. Phariss
Geological Engineer

EP/cole

C O N T E N T S

- I. Summary Description
- II. Plant Design and Operation
- III. Cessation of Operations
- IV. Review by State Agencies

Figure 1. Site Location Map

Figure 2. Site Plan

Figure 3. Extraction Plant Design

Appendix 1. Environmental Protection Measures

Appendix 2. Reclamation Statement

Appendix 3. Dust Liberation Estimates

Appendix 4. Equipment Use

Appendix 5. Membrane Tailings Toxicity Tests

Appendix 6. Membrane Tailings Permeability Tests

C O N T E N T S

- I. Summary Description
- II. Plant Design and Operation
- III. Cessation of Operations
- IV. Review by State Agencies

Figure 1. Site Location Map

Figure 2. Site Plan

Figure 3. Extraction Plant Design

Appendix 1. Environmental Protection Measures

Appendix 2. Reclamation Statement

Appendix 3. DustLiberation Estimates

Appendix 4. Equipment Use

Appendix 5. Membrane Tailings Toxicity Tests

Appendix 6. Membrane Tailings Permeability Tests

AZEREDO MINERALS, INCORPORATED
OPHER HEAP LEACH PROJECT

I. SUMMARY DESCRIPTION

Introduction

Azeredo Minerals, Incorporated, a mining and mineral processing company, in Joint Venture with The Combined Metals Reduction Company (CMR), proposes to construct and operate a mineral processing facility in Tooele County, Utah (Figure 1). The facility will engage in large scale heap leaching of ores purchased from Kennecott, dumps from mining claims owned by CMR in the Stockton Mining District and unpatented claims leased by Azeredo Minerals in the District.

The facility will be owned by Azeredo Minerals, Incorporated, a Utah mining company, with Barnes-Phariss Associates Consulting Engineers providing construction and operations management.

Location

The facility will be located on a forty-acre millsite claim held by Azeredo Minerals, Incorporated. The site is the SW $\frac{1}{4}$ of the SE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 29, T5S, R4W, roughly ten miles south of Stockton, Utah.

Operation Period

The facility will normally operate from late spring to late fall. The operating period is dictated by temperature, i.e. the facility will not commence operations until the threat of freezing temperatures is relatively low (late spring), and will cease operations prior to the onset of freezing temperatures in late fall. Initial operations are expected to commence in the summer of 1984.

Total facility life is estimated to be at least ten years. The initial amount of material to be processed is 20,000 tons annually, with production increases as economics dictate.

Summary of Plant Design and Operation

Figure 2 is a site plan. A leach pad measuring 230 feet by 150 feet will be constructed of impervious material and sloped to two excavated reservoirs. A leachate spray distribution system consisting of PVC piping and plastic lawn-type sprinklers will be installed over the leach pad. PVC piping will connect the reservoirs to extraction equipment and thence to the spray system.

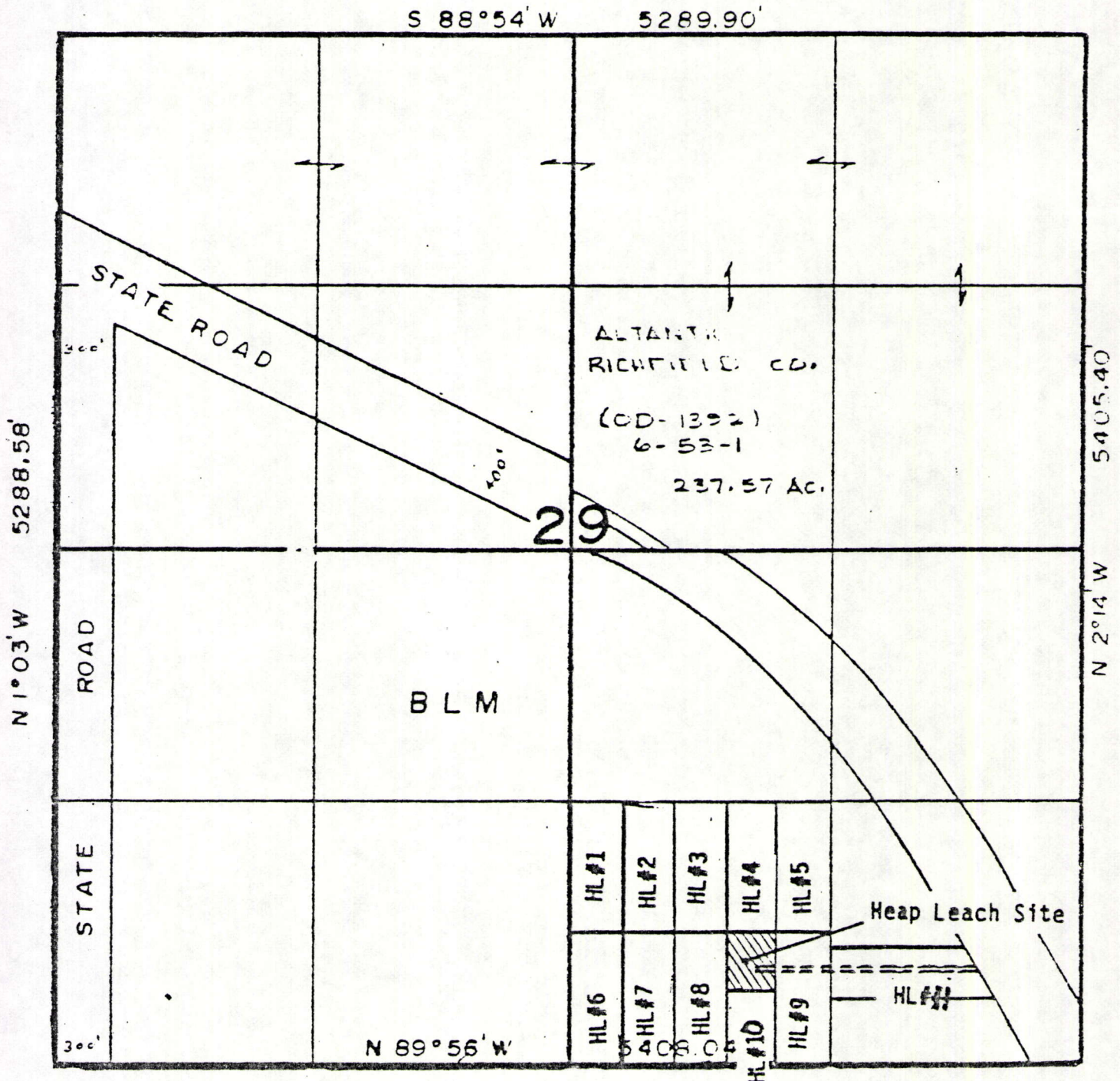
Production operations will commence with the placement of up to ten thousand tons of ore on the pad. Solutions containing from one to five pounds of NaCN per ton of solution and lime will be sprayed over the leach pad. The

AZEREDO MINERALS, INCORPORATED

OPHER HEAP LEACH PROJECT

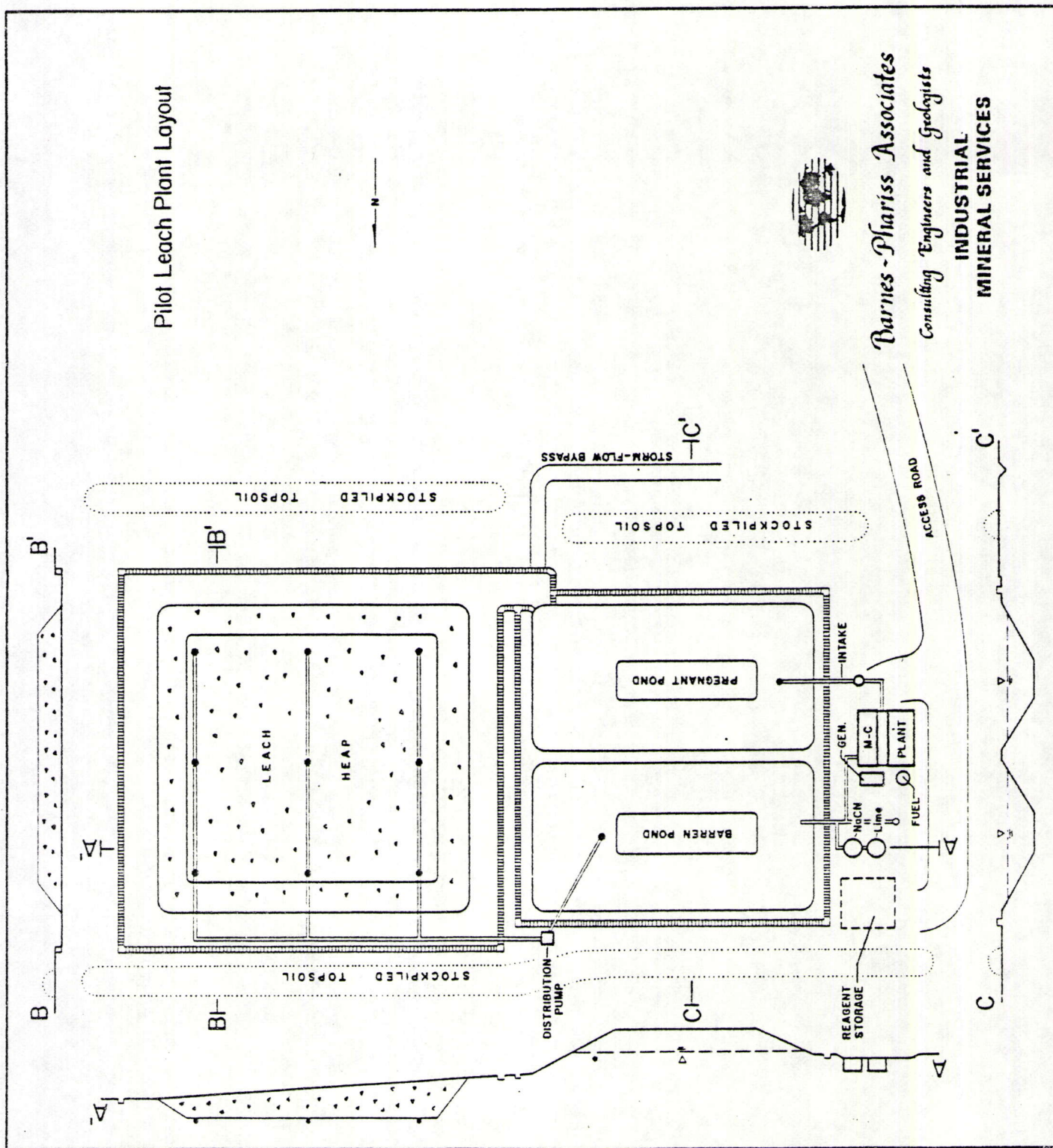


SECTION 29 ,T5 S ,R 4 W ,S.L.B.&M.



Scale 1"=800'

Pilot Leach Plant Layout



Barnes-Pariss Associates
Consulting Engineers and Geologists
INDUSTRIAL MINERAL SERVICES

leach solutions, percolating through the test material, will dissolve gold and silver values, and then flow by gravity to the pregnant solution pond.

The pregnant solutions will be filtered and passed through a Merrill-Crowe zinc precipitation plant which precipitates out the gold and silver values. The barren solution is discharged to a barren solution reservoir, NaCN and lime are added and the solution is recirculated to the leach pad.

Solution chemical levels will be maintained by taking samples during each shift. Groundwater monitoring will be conducted through periodic sampling of an adjacent water well, as well as a monitoring trench excavated below the leach pad.

During the first year's pilot scale operation, only a supervisor, three full-time hourly workers and two half-time hourly workers will be employed for day, swing, graveyard and weekend shift operations. Full-scale operations to commence in 1985 will employ a crew of ten.

Supervision

An experienced supervisor will be employed and trained for plant operation. The supervisor will serve as plant operator during each week-day shift.

Initial Operations

Operations for 1984 will initially consist of the leaching of approximately 10,000 tons of gold and silver bearing material presently located near Baur. The material is owned by Kennecott Minerals. Additional ores from the Stockton Mining District may also be treated in 1984 as time allows.

II. PLANT DESIGN

Leach Pad

A portion of the site measuring 300 feet by 150 feet will be graded to a six percent slope for leach pad construction. The leach pad area will be covered with twelve inches of clayey tailings placed in a single lift and roller-compacted to 90 percent maximum dry density. Clayey tailings for membrane construction are available from Baur. Constant head permeability tests of the material show it to be impervious to leach solutions under anticipated hydraulic heads and highly suitable for membrane construction. EPA toxicity tests show the material to be non-toxic. After completion, the leach pad liner will be moistened regularly to prevent dessication cracking.

A road of coarse mine dump material will be constructed to a thickness of five feet along the leach pad axis to form an underdrain and material haulage way. This will prevent equipment rupture of the membrane during ore dumping.

Solution Reservoirs

Two reservoir depressions, measuring 60 feet by 60 feet, will be excavated to a depth of ten feet at the lower end of the leach pad area. Side slopes, trimmed to 30 degrees and floor will then be densified by a vibrating compactor. The solution reservoirs will next be lined with two twelve-inch lifts of clayey tailings, each compacted with a roller compactor to 95 percent maximum dry density. Compacted tailings will connect the reservoirs with the leach pad. Reservoir filling will commence immediately upon liner completion.

Leachate System

The leachate spray distribution system will consist of a 575-foot, two-inch I.D. PVC header feeding 225-foot long, one-inch I.D. PVC laterals spaced 20 feet apart. Laterals will bear plastic lawn-type sprinklers at 20-foot centers, each with an effective distribution radius of 22 feet at calculated line pressures.

A 2.75-inch I.D. pipe will connect the pregnant solution reservoir to a Hawaiian filter and thence to a 300 solution ton-per-day Merrill-Crowe precipitation plant. Barren output solutions from the Merrill-Crowe plant will be conducted via piping to the barren solution pond.

Structures

Prefabricated, temporary shelters will house the Merrill-Crowe plant and all chemicals during 1984. A portable trailer may be used for office space. Permanent structures will be built for 1985 operations if 1984 operations prove successful.

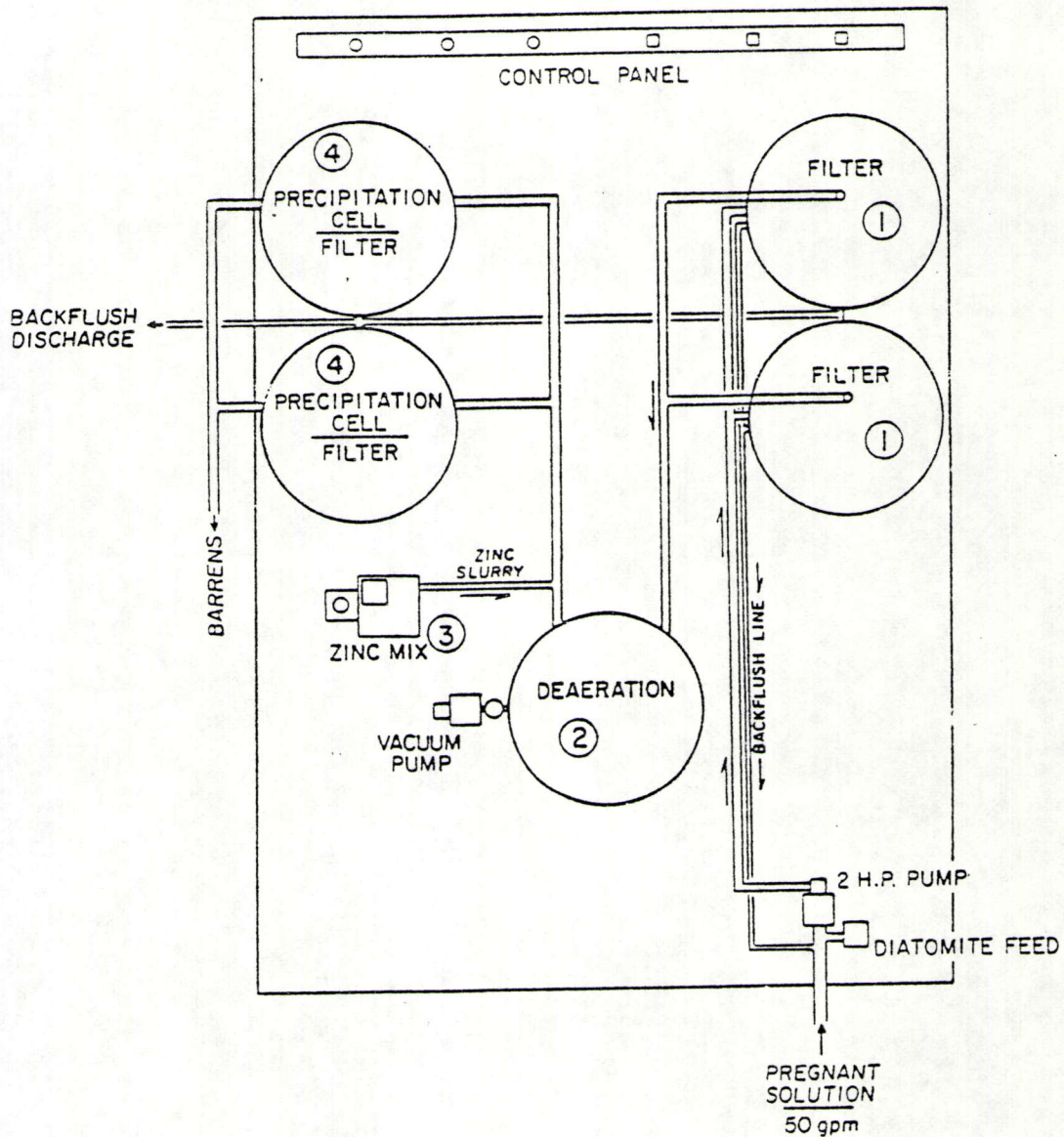
Heap Construction

Ores, either agglomerated (pelletized with water, sodium cyanide and portland cement) or "as mined", will be placed on the pad by a front-end loader. The material will be dumped along the axial roadway beginning at the east end of the leach pad. It will then be caterpillar-pushed to an average thickness of four feet over the leach pad. A maximum of ten thousand tons covering an estimated 27,000 square feet will be treated during each leach cycle.

Leachate Circulation

Solutions containing from one to five pounds of NaCN per ton and lime will be pumped from the solution pond by a five horsepower pump circulating 100 gpm to the sprinkler system on the heaped ore. Leach solutions percolating downward through the permeable ore will extract gold and silver values, collect and drain into the pregnant solution pond. Leach solutions will be cycled continuously through the leach heaps, 24 hours-per-day, 7 days-per-week, to maintain maximum pregnant solution grades.

Pregnant solutions will be removed from the solution pond by a 2.5 horsepower pump with a floating intake. Solutions will pass through a Hawaiian filter to remove suspended solids before entering the Merrill-Crowe extraction plant (Figure 3.)



Plant

Length:	6 feet
Width:	4 feet
Height:	7 feet
Weight:	2,000 pounds

300 SOLUTION TONS PER DAY
ESCAPULE MERRILL - CROWE PLANT

Pregnant solutions entering the plant through a 2.75-inch I.D. PVC line at 50 gpm first pass through diatomite filters and are deaerated in a vacuum tower. Powdered zinc is next introduced from an automatic feed box, forcing precipitation of the gold and silver. Precipitates are captured in a second bank of diatomite filters; barren solutions pass through for discharge to the barren solution pond. Make-up cyanide and lime, as dictated by test results, will be added from flow bins and bags into an open mixing drum on the barren discharge line. The adjusted solution is then recirculated to the leach pad.

The extraction plant will be operated for two eight-hour shifts daily and shut down for clean-up and maintenance during the third shift.

Monitoring

The pH of the leachate must be maintained at 11 to prevent the formation of hydrocyanic gas. To monitor the pH and sodium cyanide levels, samples will be taken at the extraction plant discharge outlet twice each shift and subjected to standard titration and pH tests for active cyanide and lime. Lime will be added as necessary to keep the pH above 11.

Environmental

Groundwater occurs beneath the leach site at a depth of approximately 300 feet below the surface. Intervening soils are interbedded sandy gravels, gravelly sands, fine sands, silty sands and occasional clay lenses.

The hydraulic gradient is westerly from the proposed site. A water supply well will be drilled on site. This well will be monitored weekly prior to commencing operations to establish quality baseline and will be tested weekly during and after operations for active cyanide. In addition, a monitoring trench filled with gravel will be located under the leach pad. Water in this trench will be tested for active cyanide daily.

Power

Power will initially be supplied to pumps, the extraction plant and surface lighting by a diesel generator. A power drop may be installed from existing Utah Power and Light lines running 600 feet east of the site in 1985.

Water Supply

A water well will be drilled on site to provide water for the operation. Pumping into a holding reservoir will commence at least two weeks before leach start-up to fill the solution ponds planned for the process facility. Ponds will be designed for excess capacity equaling twice the active solution load. Projected water demand during a six-month leach period is estimated at 1,200,000 gallons.

III. Cessation of Operations

Temporary

One month prior to the end of each operating season, the addition of make-up water to the barren solution reservoir will cease and levels in both reservoirs will be allowed to decline through evaporative loss to minimum operating depths. Spray application of leachate to the heaps will stop two weeks prior to shut down.

At shut down, residual free-draining leachate in the heaps will collect in the reservoirs and will be available for reuse in the next operating season.

Excess solution storage capacity in the solution reservoirs will protect against overflow as a consequence of winter precipitation.

Permanent

At the end of the active life of the facility incremental amounts of calcium hypochlorite or hydrogen peroxide will be mixed with the circulating cyanide solutions until all active cyanide has been neutralized. Neutralized solutions will then be circulated through the heaps until active cyanide in the heaps has been flushed out and neutralized to less than 4.75 mg. per liter. Reservoir membranes will next be perforated and the reservoirs back-filled with native soil. All piping and external hardware will be removed. The depleted ore heaps and flanking berms will finally be graded to a degree and configuration suitable for subsequent industrial construction. Topsoil will be replaced and revegetation instituted to return the area to natural harmony.

IV. REVIEW BY STATE AGENCIES

An application for exemption has been filed with the Division of Oil, Gas and Mining after conferring with the Division of Environmental Health on pad and pond construction, water and air quality control. A notice of intent has also been filed with the District Bureau of Land Management office.

Appendix 1.

Environmental Protection Measures

General

The project site hosts no identifiable endangered or rare species of flora or fauna. Surface investigations did not detect evidence of archaeological, historic or unique geologic features.

Owing to the small size of the proposed operation, only limited non-mitigated environmental impacts are anticipated. The greatest environmental threat posed by the operation will be groundwater contamination by toxic chemicals, notably sodium cyanide, to be used in the extraction of gold and silver.

Design provisions, as described below, are believed adequate to minimize the accidental loss of cyanide bearing solutions into the subsoil. Should an accidental spillage of cyanide bearing solutions occur during the course of operations, natural chemical interaction between the chemicals in solution and soils lying between ground surface and the water table at the depth of ± 300 feet beneath the site will prevent their entry to local groundwater.

Dust Control

Dust generation will only occur during the construction phase. The area of active site grading and roads for ore haulage must be properly watered during this period to prevent air pollution.

Wind

To prevent wind distribution beyond impermeable leach pad areas, the initial leach pad has been designed to provide ten feet of impermeable margin surrounding the active leach area. Assuming the use of lawn type sprinklers operated at 40 psi line pressure and with distribution radii of 22 feet, five (5) feet of safety will be provided against spray distribution beyond the impermeable leach pad at wind velocities of up to 30 miles per hour.

To protect against environmental degradation at higher wind velocities, the spray distribution system will be shut-down at wind velocities in excess of 30 mph, and will be restarted only when wind velocities decrease below 30 mph.

Seepage Loss Monitoring

A seepage detection ditch sealed with PVC and draining to a monitoring sump has been incorporated in the facility design to detect leach pad seepage loss. The sump will be monitored during each shift for the appearance of moisture. Should excessive moisture appear in the sump, it will be immediately sampled and tested for cyanide. The detection of cyanide will result in immediate spray system shut-down. Operations may only resume when the

seepage source has been located and proper measures taken for total correction.

The facility's water supply well will serve as a monitoring point for general loss and detection of cyanide solutions. The well will be sampled once daily throughout operations. Samples will be analyzed for cyanide by the Rocky Mountain Geochemical Laboratory, Salt Lake City, Utah. The appearance of any cyanide in well water will result in immediate plant shut-down, problem identification and rectification.

Retention Pond Capacity

Excess ponding capacity has been incorporated in the pregnant solution pond to store runoff from the five-year 24-hour maximum storm estimated for the area. Should meteorologic predictions or a series of storms indicate that storm run-off from the leach pad area may exceed pond retention capacity, peroxide will be added to the pond to neutralize cyanide bearing solutions in the pond before overflow may occur.

Hazardous Waste

Containers for dry sodium cyanide delivery are retrieved by the supplier, Van Waters and Rogers, when empty. No other hazardous chemicals will be utilized at the facility. Cyanide in active use in recycled leach solutions is not categorized as waste until project shut-down and site abandonment, procedures for which are described in Appendix 2.

Employee Safety

Shift managers will be trained and certified for the safe use of cyanide chemicals by Van Waters and Rogers, Chemical Suppliers, Salt Lake City, Utah, and will in turn be responsible for training support personnel and job safety.

The open-framework construction of housing for the Merrill-Crowe Precipitation Plant and reagent storage building at the facility will prevent the buildup of toxic gases at workplaces, should such gases be accidentally generated.

Appendix 2.

Reclamation Statement

General

The reclamation plan assumes the heap leaching of 20,000 tons of material annually for a period of ten years. The plan is equally applicable should the 1984 pilot leach operation prove unsuccessful.

At the end of the active life of the facility, small amounts of calcium hypochlorite or hydrogen peroxide will be mixed incrementally with the circulating cyanide solutions until all active cyanide is neutralized. This solution will then be circulated over the heaps until the active cyanide in the heaps has been diluted to a point where the overall solution contains less than 4.75 mg. per liter NaCN.

Pre-Reclamation Site Conditions

The site will bear ± 200,000 tons of coarse silty sand to sandy gravel representing crushed ore material from which metals have been leached. The material will have a residual moisture content ranging between 6% and 12%, a pH of between 7 and 11 and will contain no residual toxic or hazardous chemicals.

The material will form a mound covering ± 3 acres to a height of 30 feet, and will be underlain by an impervious membrane of compacted, clayey tailings. Reservoirs will consist of four clayey tailings lined ponds, each 60' x 60' x 10'.

Construction will include a 1) pre-fabricated metal building on a cement spread footing foundation, 2) a 6" diameter water well to a depth of ± 300 feet, 3) an electric utility line 1,400 feet in length, 4) a sunken, 100 gallon reagent mixing drum, 5) two 50 g.p.m. pumps mounted on 3' x 3' x 1' spread matt concrete foundations, 6) miscellaneous surface P.V.C. piping, and 7) barb-wire fencing enclosing the ± five acre site.

Reclamation Upon Abandonment

1. Surface buildings will be dismantled and removed.
2. Miscellaneous piping will be dismantled and removed.
3. The reagent mixing drum will be excavated and the depression backfilled.
4. The axis of each reservoir will be caterpillar trenched to native soil to promote drainage into the subsoil.
5. Spread footing and matt concrete foundations will be excavated and the rubble backfilled into the ruptured reservoirs.
6. Reservoirs will be backfilled with sandy gravelly leached ore materials.
7. The perimeter of the leached ore material will be caterpillar pushed outward to cover tailings-lined leachate collection ditches and to reduce side slope angles to less than 20°.

8. Topsoil stockpiled around the perimeter of the leach mound will be feathered upward, onto the flanks of the mound, to promote the encroachment of native revegetation.
9. Topsoil stockpiled around the perimeter of the construction area will be spread by grader over the area.
10. The access road will be trenched diagonal to the fall line to prevent rapid runoff and erosion.
11. Power supply-line, well and pump will be left in-place as a monitoring point for groundwater quality and future source of livestock/wildlife water.
12. The enclosing fence will be removed.

Summary

The non-toxic, non-hazardous and soil-like nature of materials to be imported to the site for processing and the foregoing reclamation measures should promote the rapid growth of native brush, soil generation and native grasses over the site.